LIVERMORE LAB REPORT

A weekly review of scientific and technological achievements from Lawrence Livermore National Laboratory April 7-11, 2014.

NATIONAL GEOGRAPHIC

ENERGY REPORT CARD MEASURES UP

Wind power saw the highest energy gains from 2011 through 2013, according to the most recent U.S. energy flow charts released by the Lawrence Livermore National Laboratory.

The United States used more energy in 2013 than the year before, but efficiency rose, too.

That increase in energy use, as documented in the energy flow charts from Lawrence Livermore, coincides with the fourth consecutive year of economic growth, but the longer-term trend shows the country operating with greater efficiency while also revealing the small but growing role of renewable sources such as solar and wind.

The flow chart is an annual tally of U.S. energy consumption that connects energy sources with their end uses in the residential, commercial, industrial and transportation sectors. There's a large "rejected energy" component, for energy that is consumed but not put to use, like waste heat. The chart showed energy use at 97.4 quadrillion British thermal units, an increase of 2.3 quads over 2012.

To read more, go to *National Geographic*.

For another article, go to *U.S. News & World Report*.

Popular Mechanics **THE TRUTH ABOUT FUSION**

A NIF target contains a polished capsule about two millimeters in diameter, filled with cryogenic (super-cooled) hydrogen fuel.

Omar Hurricane studies nuclear fusion at Lawrence Livermore's National Ignition Facility. In February, Hurricane's team took the biggest step toward fusion ignition yet.

Fusion, the same energy that powers the sun and the stars, is the process of combining atoms so that they bind together. Quite a lot of energy is produced when this happens.

"While people have already created fusion in experiments for decades, it's always been a process that takes in a lot more energy than it gives out. And it doesn't have to be," Hurricane said. "We're trying to bring experimental fusion to a point where the whole process starts to feed back on itself -- where fusing atoms encourages more fusion to happen so that it becomes self-sustaining -- which we call ignition. And that's going to be necessary if fusion is ever going to be useful for power generation."

To read more, go to *Popular Mechanics*.

NATIONAL GEOGRAPHIC **A NEW ENERGY FRONTIER**

Machines work on a surface coal mine in Wyoming's Powder River Basin. Some energy companies are proposing a different approach to coal: igniting it underground to produce gas for fuel.

Underground Coal Gasification (UCG) is gaining new enthusiasts who say it can transform abundant but difficult-to-mine coal reserves into a cleaner fuel: synthetic natural gas. Instead of mining the coal, the companies propose to drill into the coal seam, ignite it and capture the "syngas" -- a combination of hydrogen, carbon dioxide and methane -- produced by the oxidation underground.

In a demonstration project during the 1970s energy crisis, Lawrence Livermore spearheaded a test at Hoe Creek, Wyo. Pressure built in the cavity where the coal was burned to levels far higher than in the surrounding rock, pushing contaminants away from the cavity and polluting groundwater with benzene, a carcinogen. Researchers who have studied what went wrong believe that part of the problem was that the shallow coal strata was too close to potable aquifers.

But new horizontal drilling techniques allow engineers to reach and penetrate deep coal seams, at 550 meters (1,800 feet) or more. And that's lessened the risk of groundwater pollution, companies say.

David Camp, who leads Lawrence Livermore's UCG program today, says that having strong regulations in place and enforcing them will be key. "When UCG has been done poorly in the wrong location, there has been significant groundwater contamination," Camp said. "So you need to do things right."

To read more, go to *National Geographic*.

COOL IT

LLNL Engineer Ruben Ocampo (left) and Sustainability Manager Michael Cowen discuss the features of a reverse osmosis system that could potentially save seven million gallons of potable Hetch-Hetchy water.

Lawrence Livermore has launched a pilot project to reduce potable water use by using treated groundwater to cool equipment and research facilities at the main site.

Water from one of LLNL's treatment wells is being run through a reverse osmosis filtration unit and used as an alternative to the Hetch-Hetchy water used in a cooling tower on the west side of the Lab. Use of the treated groundwater reduces the need for water from the Hetch-Hetchy Reservoir operated by the San Francisco Public Utilities Commission and the associated cost.

"This is part of an ongoing effort to conserve water, reduce costs and help the Laboratory meet its environmental goals," said Michael Cowen, LLNL sustainability manager. "At a time when water conservation is a matter of public concern and discussion, we continue to strive to identify innovative ways to improve water efficiency."

To read more, go to *nanowerk*.

THEY CALL IT A REVOLUTION

Former Lawrence Livermore researchers Lloyd Hackel (left) and Brent Dane successfully commercialized a laser peening technology at LLNL and used it to become entrepreneurs at their current company, the Metal Improvement Company (MIC).

Most people don't realize it, but the airplane they are flying on may be stronger because of a pair of former Lawrence Livermore researchers who developed and commercialized an innovative but relatively obscure technology.

Lloyd Hackel and Brent Dane found a way to improve laser peening and commercialize it, enabling the aviation industry to manufacture wings and engines blades that are more fuel efficient and fatigue resistant. The revolutionary technology has saved the industry hundreds of millions of dollars and improved passenger safety.

They decided to leave the Laboratory a decade ago and embark on a career as entrepreneurs, and took a leap of faith with their technology. They ended up working for the Metal Improvement Company (MIC.

To read more, go *to phys.org*.

LLNL applies and advances science and technology to help ensure national security and global stability. Through multi-disciplinary research and development, with particular expertise in high-energy-density physics, laser science, high-performance computing and